Contents

De	eclara	tion of	Authorship	iii		
Al	Abstract			vii		
A	Acknowledgements					
1	Introduction and Literature Review					
	1.1	The at	tmosphere	1		
		1.1.1	Structure	2		
		1.1.2	Composition and chemistry	3		
		1.1.3	Radiative Forcing	3		
	1.2	Ozone	2	4		
		1.2.1	Stratospheric ozone	4		
		1.2.2	Tropospheric ozone	7		
		1.2.3	Stratosphere to troposphere transport	9		
		1.2.4	Chemical production	10		
	1.3	Volati	le Organic Compounds	11		
		1.3.1	Emissions	13		
		1.3.2	Isoprene	14		
		1.3.3	Isoprene chemistry	15		
			Oxidation	15		
			High NOx pathway	17		
			Low NOx pathway	17		
			Night time processes	18		
	· · · · · · · · · · · · · · · · · · ·		aldehyde	19		
		1.4.1	Sources and sinks	19		
		1.4.2	Measurement techniques	20		
			Satellite measurements	21		
	1.5	Atmos	spheric Chemistry Modelling	23		
		1.5.1	Box models	23		
		1.5.2	Chemical transport models	23		
		1.5.3	Emissions	25		
		1.5.4	Uncertainties	25		
			Emissions Inventories	26		
			Resolution	26		
			Chemistry mechanisms	26		
			Clouds	27		
			Soil Moisture	27		
	16	Anetr	alia and the couthern homisphere	27		

		1.6.1	Ozone	29
		1.6.2	VOCs	30
		1.6.3	Measurements	30
	1.7	Aims		31
2	Data		Modelling	33
	2.1	Introd	uction	33
	2.2	Datase		33
		2.2.1	Daintree	34
		2.2.2	Marine and Urban MBA ? (MUMBA)	34
		2.2.3	Sydney Particle Studies (SPS1, SPS2)	34
		2.2.4	Satellite	
			OMNO2	38
			OMHCHO	38
			OMAERUVd	42
			MOD14A1	42
		2.2.5	Drought Index	42
	2.3	GEOS	-Chem	43
		2.3.1	Outline	43
		2.3.2	Running GEOS-Chem (before isop?)	43
			Installation and requirements	43
		2.3.3	GEOS-Chem isoprene modelling	44
		2.3.4	Chemical Mechanisms	45
		2.3.5	Emissions from MEGAN	46
		2.3.6	Rescaling NOx	47
		2.3.7	GEOS-Chem outputs	50
		2.3.8	GEOS-Chem simulations	59
			Run comparisons	60
	2.4		rement Techniques	60
		2.4.1	DOAS	64
		2.4.2	Satellites	64
			LIDORT	
			OMI	66
			Air mass factor (AMF)	68
			Uncertainties	69
		2.4.3	Calculating an AMF	
	2.5		culation of OMI HCHO	74
		2.5.1	Outline	75
		2.5.2	Creating new shape factors	76
		2.5.3	Reading satellite data	
		2.5.4	Creating the new AMF	78
		2.5.5	Recalculating the AMF using PP code	79
		2.5.6	Vertical columns from AMF	80
		2.5.7	Reference sector correction	80
		2.5.8	Binning the results daily	84
		2.5.9	Difference between new and old OMI HCHO columns	85
	2.6	Filteri	ng Data	85

		2 (1	Eine and analys		. 87
		2.6.1	Fire and smoke		
		0.60	Checking that fire masks are influencing pyrogenic HCHO		
		2.6.2	NOx		
		2.6.3	Summary of filters effects on HCHO		
	2.7	Data .	Access		. 93
3	Bio	genic Is	soprene emissions in Australia		97
	3.1	_	luction		. 97
		3.1.1	satellite inversions		
		3.1.2	MEGAN emission model		
		3.1.3	Top-down emissions estimates		
			Linear		
			Bayesian		
		3.1.4	Aims		
	3.2		ods		
		3.2.1	Outline		
		3.2.2	Calculating modelled slope		
		3.2.3	Satellite inversion		
		3.2.4	Calculation of Emissions		
		3.2.5	Emissions drivers		
		3.2.6	HCHO Products and yield		
		3.2.7	Accounting for smearing		
	3.3		ts		
	0.0	3.3.1	Emissions comparisons		
		3.3.2	Emissions affect on GEOS-Chem		
		3.3.3	Comparison with in-situ measurements		
	3.4		rtainty		
	0.1	3.4.1	Model Uncertainty		
		3.4.2	Satellite Uncertainty		
		3.4.3	Fire Filtering		
		3.4.4	MEGAN		
		5.1.1	WEOZIV		. 110
4		-	eric ozone intrusions		117
	4.1		duction		
	4.2		and Methods		
		4.2.1	Ozonesonde record in the Southern Ocean		
		4.2.2	Model description		
		4.2.3	Characterisation of STT events and associated fluxes		
		4.2.4	Biomass burning influence		
		4.2.5	Classifying synoptic conditions during STT events		
	4.3	0			
	4.4				
	4.5		osphere-to-troposphere ozone flux from STT events		
		4.5.1	Method		
		4.5.2	Results		
		4.5.3	Comparison to literature		. 136
	4.6	Sensit	tivities and limitations		. 141

		4.6.1 Event detection	141				
		4.6.2 Flux calculations	142				
	4.7	Conclusions	143				
	4.8	Contributions and Acknowledgements	144				
A	Sup	applementary Notes					
	A.1	1 Measurement Techniques					
		A.1.1 MAX-DOAS	145				
	A.2	Data sets	145				
		A.2.1 SPEI	145				
		A.2.2 GOME	145				
		A.2.3 NPI	147				
	A.3	Chemistry	147				
		SOA	147				
		A.3.1 Relationship to Glyoxyl TODO: remove if never used	148				
	A.4	CAABA/MECCA	151				
		CAABA/MECCA outputs	152				
		A.4.1 CAABA/MECCA Box model: isoprene source classifications	152				
	A.5	Satellite Stuff	154				
		A.5.1 OMI Algorithm BOAS	154				
		A.5.2 AMF recaulculation using 72 level output	155				
		A.5.3 Old Fire Product MYD14C8H	157				
В	App	Appendix A					
		Grid Resolution	161				
C		uently Asked Questions	163				
	C .1	How do I change the colors of links?	163				
Bi	Bibliography 16						